# Greenberg, Judith 2022

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GM: Today is January 27, 2022, and I'm about to serve as moderator in the creation of an oral history of Dr. Judith Greenberg, most recently serving as deputy director of the National Institute of General Medical Sciences (NIGMS). I am Dr. Gordon Margolin, volunteer in the Office of NIH History and Stetten Museum. Thank you, Dr. Greenberg, for your willingness to participate in this program.

JG: Thank you.

GM: Let's start by hearing briefly about your early life, your or your parents' aspirations for your future, and your rapid transit through high school and your choice of college.

JG: I'll start with my mother who wanted to go to medical school herself but didn't have the money, so she went to nursing school instead and subsequently received her bachelor's and her master's degrees. But she put her hopes of becoming a physician in me, as an only child. I can remember being "indoctrinated" into the idea that I was going to be a doctor. For example, from the earliest years she taught me the names of all my bones so if I fell down and hit my knee I would say, "I hurt my patella."

A little-known fact is that I didn't graduate from high school. I grew up in a small town, Margate, New Jersey, which is near Atlantic City. It was pleasant but it didn't offer very many opportunities beyond the usual social activities. My parents, who were ambitious for me, encouraged me to apply for college early, so I could begin college after my third year of high school. Besides, my mother knew the training to be a physician would take a lot of years and thought it would be good for me to get an early start. I applied and was accepted at the University of Pittsburgh. At that time they had a calendar with three trimesters, so if you went all three trimesters you could graduate in three years, which is what I did.

Everything was going according to my parents' plan—that is, until my last year of college. At that point I took a job in a lab doing research. I got very turned on to research and decided that I wanted to go to graduate school rather than to medical school. It was probably my only youthful rebellion, but fortunately my parents accepted my decision.

I don't want to make this story sound at all negative because my mother, in fact, was my most important role model. When I was growing up in this little town—I can only call it a little Ozzy and Harriet town--my mother was the only mother of any of my friends who worked outside the home, and her ambition and her professionalism taught me a lot and really served as a model for me. I also have to give credit to my father, whose analytical and organizational skills and scholarly interests rubbed off on me. That is my early childhood.

GM: An interesting background. Please tell us how you became interested in developmental biology as your area for your PhD and briefly explain what developmental biology is.

JG: Let me start with the definition first. Developmental biology is the study of how animals and plants grow and develop. It includes embryology but also regeneration and a whole variety of changes that take place later in organisms. The undergraduate lab in developmental biology that I worked in at college was studying a very simple animal, known as hydra. When I say simple, really, it's often described as a tube within a tube. I mean that's all it is, but a fascinating animal. The lab was looking at how cells move and regenerate new body parts. So developmental biology caught my interest. I went on to get my PhD at Bryn Mawr College with Dr. Jane Oppenheimer. She was a well-known classical developmental biologist. For my PhD thesis I studied the development of thrombocytes, the equivalent of platelets, in chick embryos.

GM: That's an interesting road you took. Then how did it go from there, moving into the journey to NIH? Would you have had any jobs before you started at NIH?

JG: Sure. Let me just give you a little more personal background. While I was in graduate school, I met my husband, Warren (on an airplane, by the way). He was a graduate student in economics. When we completed our degrees, we decided to move to the Washington, DC area where he took a position at the Federal Trade Commission, and I became a postdoc at the Red Cross Blood Research Laboratory in Bethesda. This was a research facility that no longer exists. My goal there was to learn biochemistry while investigating the process of platelet aggregation, which is necessary for the blood to clot. I spent a couple of years there, but I did want to return to my true interest of developmental biology, and that's how I ended up at NIH.

GM: Once again, let's step back to developmental biology. What would you call that phenomenon now? I don't know that the words "developmental biology" are in my vocabulary.

JG: What would we call developmental biology now? Developmental biology still very much exists as a discipline but it's approached from entirely different directions than it was decades go. When I was doing research, we simply did not have the tools that are available now. For example, you couldn't clone a gene; you couldn't change, delete, or insert a DNA sequence. The ability now to use genetic and molecular biology tools like these means that developmental biology has in many respects merged with other disciplines.

GM: We'll get back to genetics and genomes as we pursue your course here at NIH, but it's obvious that an awful lot has happened in the period of time that you've been involved here. You first came here, as I remember, to the National Institute of Dental Research, which is now called the National Institute of Dental and Craniofacial Research. What was the nature of the research you were doing in that setting? It was dentistry.

JG: I was in the lab of Dr. George Martin. The lab was called the Laboratory of Craniofacial Biology and Anomalies, and my main research project was studying the neural crest. This is a tissue that migrates along the neural tube in the early embryos of all vertebrates, and it differentiates into an amazing variety of cell types such as different kinds of neuronal cells, cartilage, and melanocytes. I was interested in learning where particular neural crest cells migrated and what they differentiated into in those locations. These were interesting and challenging questions but we didn't have the appropriate tools to study them. I'm fascinated now when I read about neural crest and see what researchers can do to understand, at the cellular and molecular level, exactly where these cells are moving. But back then, this was just not possible.

GM: Then you moved to the NIGMS, the National Institute of General Medical Sciences, where you spent the rest of your whole professional life. What brought about this move?

JG: Well, like most people who move from research to administration, I had the sense that what I was doing, hands-on in the lab, was becoming increasingly narrow, and I wanted an opportunity to follow science more broadly and have a greater impact than I could with my own research going on in my own little lab. At the time Dr. Ruth Kirschstein was the director of NIGMS, and somehow her husband Dr. Al Rabson heard about me and put us in touch. Ruth hired me and that was the beginning of about four decades of NIGMS.

GM: So from that point on there wasn't a lot of hands-on science by you. It was more administration. Is that right?

JG: That's correct, and I'll talk a little bit about this.

GM: Let's get a definition of the role of NIGMS in this whole view of institutes at NIH exactly. What is the mission and outlook and hopes from the NIGMS viewpoint?

JG: NIGMS has three distinct but complementary missions. Probably the best known is its support of basic research, but it also is a huge player in research training at all career levels, from elementary school all the way up through early career professionals. The third mission is capacity building. I'll talk a little bit about each one of these.

The research and the training parts of NIGMS' mission were established by Congress 60 years ago. The institute is now 60 years old. Capacity building was added more recently when the National Center for Research Resources was broken up. So, let me go through the programs one by one and then, if you have any questions specifically about them, you can interject.

As far as the basic research aspect of it, NIGMS funds projects in areas such as cell and developmental biology, genetics, chemistry, pharmacology, physiology, biochemistry, biophysics, computational biology, and technology development. All these areas are designed to address how cells, organs, and organisms work, but they're not focused on specific diseases. If they're focused on specific diseases, the projects would be assigned to one of the other institutes. Again, NIGMS uses its money for very, very fundamental kinds of studies, and many of the projects make use of what we call research models, or model organisms, such as flies and worms and bacteria. That is the largest part of NIGMS' research portfolio, but interestingly, NIGMS is also charged with supporting a few cross-cutting clinical areas which affect many of the institutes, for example, research on sepsis, trauma and burn injury, and anesthesiology. So there's a little bit of clinical research there.

Moving on to the training area, NIGMS has a huge number of programs, as I said, aimed at all career stages and I won't mention all of them, but some of the most well-known are the institutional training grants for pre-docs, the MARC [Maximizing Access to Research Careers] program for undergraduates at minority or minority-serving institutions, individual post-doctoral fellowships, and programs that help students bridge from two-year colleges to four-year colleges or from four-year colleges to graduate school.

We also have a new program that just started a couple of years ago, called MOSAIC [Maximizing Opportunities for Scientific and Academic Independent Careers], which is interesting. It is meant to enhance the diversity of faculty at universities. The way it does this is by developing cohorts of post-docs from diverse backgrounds and helping them transition from their post-doctoral research into independent positions at universities or medical schools.

The third area that I mentioned is capacity building, and this is made up of several programs. I'll mention just a few. One is the so-called IDeA [Institutional Development Award] program, which makes competitive awards to states that have a relatively small amount of other NIH funding. We also have a program called NARCH, which stands for Native American Research Centers for Health, focused on enhancing research by Native Americans. There is the Support for Research Excellence, or the SuRE, program that supports faculty development at institutions that primarily serve students from underrepresented groups. There's a program called SEPA, the Science Education Partnership Awards, that makes grants to individual schools or libraries or museums or other organizations to bring STEM [science, technology, engineering, and mathematics] education to kids of all ages. Finally, I'm very proud to say that one of the capacity-building programs I helped to conceive right before I retired is the Regional Technology Transfer Accelerator Hubs for IDeA States. The program is meant to enhance the entrepreneurship of scientists in these states, to better enable them to apply for small business grants and other kinds of startup funding.

One more important thing about NIGMS, that comes back to something that you alluded to earlier: NIGMS is the only institute that does not have an intramural program, that is, a group of scientists who work in laboratories at NIH. Rather, none of NIGMS staff conduct their own lab research, so this allows the entire institute to focus 100 percent on the extramural community, namely, the investigators at universities and medical schools throughout the United States.

GM: Now how does that work? Do they have to apply for grants on an annual basis to NIGMS for their ongoing research?

JG: Investigators apply for research grants, and depending upon the topic, the project is assigned to an [NIH] institute for potential funding and to a study section for review and, if the grant merits it, it'll be funded. Most grants are funded for between three and five years.

GM: Do you do anything to oversee the operation of those grants during that period of time or the progress of their scientific activities?

JG: Yes. Investigators are responsible for turning in progress reports - scientific progress reports, as well as financial reports every year. Program and grants management staff follow up with the investigators when issues arise.

GM: You must contribute an awful lot to the funding of all these extramural grants at this level. How much money does NIGMS have to be able to do that every year?

JG: I think NIGMS' most recent budget is about 3 billion dollars.

GM: You must have a big list of applicants and applications and follow-through requirements. Do trainers go out into the community and help teach people to do research and to seek out the diverse individuals in diversity programs and so forth, or does that all happen by itself? Out in the world?

JG: No. You know it's not done these days with the pandemic going on. But even before that our travels were limited. In general, though, there are any number of opportunities to reach our community through attending scientific meetings, holding webinars, and sending out information on social media, as well as issuing Funding Opportunity Announcements (FOAs). All these approaches alert the community of various programs that we have or of particular interests that we might want to bring to their attention.

GM: Are your contributions confined to the United States?

JG: Occasional grants are made to investigators in other countries but it's a tiny, tiny bit.

GM: I think you told me that a significant number of Nobel [Prize] recipients had come through your program and been developed as scientists or as investigators under your aegis and ultimately were awarded Nobel recognition. How many do you think you fostered?

JG: As of 2021, NIGMS supported 92 Nobel laureates. Part of the reason that NIGMS can claim the lion's share of Nobel laureates is that it supports cutting-edge basic research, and that's the kind of research that often wins Nobel Prizes. Every October we watch the news very closely early in the mornings when the announcements are made in Sweden to see whether any of our grantees have won.

GM: In what areas have you had your people receive Nobel recognition?

JG:  Our grantees win Nobel Prizes in Physiology or Medicine and in Chemistry. NIGMS maintains a list of Nobel laureates that we've supported with these topics. https://www.nigms.nih.gov/pages/GMNobelists.aspx#:~:text=Since%20its%20creation%20in%201962,normal%20life%20processes%20and%20disease.

GM:  It seems to me when the Nobel Prize is awarded, many times the research of the laureates had been done 20 or 30 years before and only well recognized at the current time of awards. How do you keep all these guys in mind when you sit and listen for their names?

JG:  We have great databases.

GM:  I would think you must just have a lot of names on your list.

JG:  There is an NIH-wide database that maintains information on every application that an investigator has put in, whether it was funded, and for how much money and for how long, as well as other information. It's pretty easy to find these things.

GM:  That's good to hear. It would be confusing to me to try and recall all those names from many years back, but you obviously have set up a system that remembers the recipients. There was also a question about development or involvement with newer technology sponsored by NIGMS. Can you say a word about that?

JG:  Sure. Technology development is one of the areas that NIGMS and many other institutes support. As is the case with other kinds of research, technology development specific for a disease or organ system is supported by other institutes, while NIGMS supports what is usually early-stage technology development that underlies the more targeted interests of other institutes.

I want to point out one recent technological development—and I'll tell you why I'm selecting this one—that is cryo-EM, or cryo-electron microscopy. This has become important and popular in the last, I would say, seven or so years. It's an amazing technique for determining the three-dimensional structure of proteins. What makes it so important is that, unlike the "old days" where you had to have a crystal in order to determine the structure of a protein or a peptide, for cryo-EM you don't have to crystallize the protein. This has been incredibly important for understanding structures of many, many proteins. In the last couple of years, for example, cryo-EM has really helped advance the understanding of how antibodies bind to the spike protein of COVID-19. But the number of uses for cryo-EM is just infinite. That's one of my favorite recent examples.

GM:  When you first came to NIGMS, did you face any particular challenges because you were a woman?

JG:  That's a really good question, but the answer to that is not really. Don't forget Dr. Kirschstein was the director of the institute. She, in fact, was the first female institute director in history, and she hired a significant number of women, many of whom advanced to senior positions at NIGMS or elsewhere at NIH. There are many NIH women today who, if you ask them, would say that they consider her their mentor, just as I do. I think she had a real appreciation for the diversity that came from having women. She also appreciated that there were issues if you were a woman and had small children. I've been pleased that the culture of the institute from all the way back, from the time that Dr. Kirschstein hired me, to the current time has remained the same, with a recognition of the importance of work-life balance. That's always been the belief from the top down.

GM: Is there a large turnover of personnel within your institute or is there quite a stable group over many years?

JG:  There are times that everything seems to be very, very stable for a long period and then suddenly a couple of staff retire, and that causes some churn as some people move into new positions. I don't think it's a huge turnover. I've always thought that having some turnover is good as it brings in new ideas. We might make an effort to bring people into a position, not only from within NIGMS or another NIH institute but from the outside because they may bring fresh ideas. I think it's probably just about the right amount of turnover.

GM:  That's good. When you first joined NIGMS you were a program director, I see in your CV, and then you were promoted to a branch chief, a division director, and finally to be the institute's deputy director. You also served twice as the institute's acting director. What were your general responsibilities in all these different roles?

JG: When I started, in my 20s, as a naïve program director, I was given a portfolio of about 150 grants to manage. This meant that I attended study section meetings to hear reviews, I followed the literature in the area, I participated in funding decisions, and I read scientific progress reports. As I learned my way around, I also took responsibility for managing institutional training grants in genetics. It was a variety of standard things that program directors do. When one of our branch chiefs left, I was appointed to that position and, in addition to what I had been doing before, I supervised three or four program directors. During that time I also increased the number of special activities that I was involved in. Then I became the director of what was then called the Division of Genetics and Developmental Biology. In NIGMS this is a leadership position, so I took on higher levels of responsibility including providing advice to the director of the institute.

Then in 2002, NIGMS' director, Dr. Marvin Cassman retired. Normally in such a situation the deputy director serves as acting director until a new director is named, but NIGMS was one of those rare institutes that didn't have a deputy director. So I was asked to serve in the role of acting institute director, and that assignment lasted for about a year and a half. Then I returned to being a division director. But when our next director, Dr. Jeremy Berg, left, I was again asked to serve as acting director of NIGMS, and that was for a period of about two years. Our next director, our current director, is Dr. Jon Lorsch, who wisely chose to have a deputy director. It was a competitive recruitment, and I was selected for the job. I remained as deputy director until my retirement.

GM: What were some of the biggest challenges you had in being an administrator all those years?

JG: I would say that once I was in a supervisory position, I always considered my biggest challenges to be hiring the best people, training them well, encouraging collegiality, and then giving them as much opportunity for growth as they wanted, because I had seen that worked for me and I think it works for many, many other people as well.

GM: Now you said that during the course of this time, in addition to being an administrator, you had a number of special assignments that you undertook and helped develop for NIGMS or NIH. I think our listenership or readership of this document would understand the concept better how NIGMS has progressed by hearing some of your favorite opportunities that you developed during this time. For example, you took over as a principal leader of two prominent NIH grant programs, namely, the NIH Director's Pioneer Awards and the NIH Director's New Innovator Awards. We'd like to hear the background and details of these two programs and about your roles in them.

JG: Okay, so this is interesting. When Dr. Elias Zerhouni was the NIH director, he initiated the NIH Director's Pioneer Award program. This was designed to provide a small number of highly innovative researchers with large grants and the freedom to do pretty much what they wanted to do with that money. At the end of the application process and the decision process the first year, all the recipients of the awards were men—I believe it was seven men and no women—and very little diversity. So, Dr. Jeremy Berg, the NIGMS director, went to Dr. Zerhouni to raise his concern about this outcome. The next thing we knew I was put in charge of the program. Happily, we managed to turn around the numbers by the second year and ended up making awards to a diverse group of outstanding investigators, and that's been the case since then. I continued managing the Pioneer Awards for the next six years or so. That was actually a terrifically fun thing, because the people who were the awardees were incredibly innovative, interesting people and it was wonderful to get a chance to meet them.

But, as they say, no good deed goes unpunished, and in 2007 Congress asked Dr. Zerhouni what he would do if they appropriated a certain amount of money for anything he wanted. His response was that he'd use it for something along the lines of the Pioneer Awards but for early career investigators. So he again turned to me, and he asked me to create the program which we called the NIH Director's New Innovator Awards, but the money had to be spent that fiscal year. You may not be aware of it, but the bureaucracy typically moves rather slowly, and to do anything in less than a year is almost unheard of. In that short time we had to develop a program, to review applications, and make awards. We got thousands of applications because every researcher considered him or herself to be an innovator. Fortunately, I had amazing help from people all over NIH, and the program took off and we made it within the time period that we had to spend the money. Both the Pioneer Awards and the New Innovator Awards are going strong after all these years.

GM: About how many people have you funded or how many do you fund per year for those awards?

JG: For the New Innovator Awards the range of grants made each year is 30 or 35. For the Pioneer Awards it's a much smaller number, between about 7 and 10, because the grants are also much larger .

GM: And have these proved to be very profitable grants that turn out unusual results?

JG: We've had a number of evaluations of the Pioneer Award Program, and they do seem to encourage some risk-taking, which is supposed to be part of it. There is more innovation than one would expect perhaps in a regular standard grant, so I think overall they've been successful.

GM: Yes, that's very exciting granting opportunities and you say it's ongoing, it hasn't stopped.

JG: Right. They're still going very strong.

GM: …and still being funded obviously. Terrific. Then you also undertook another project which went on for many years, from 1984 to 2011. You were the project officer of the NIGMS Human Genetic Cell Repository, starting apparently even before the genome was fully delineated. What exactly did this mean and what was the anticipation of this project?

JG: The repository started back in 1972. It's a collection of fibroblast and lymphoblast cell lines and DNA samples made from the cell lines. Originally the samples came mostly from people with a variety of genetic disorders or from so-called normal people with no apparent disease. Gradually the collection evolved to also include samples from families that might have had some particular disease running through it, and also from members of specific geographic or ethnic population groups. These days it also contains samples that are from so-called induced pluripotent stem cells. All these samples are available to researchers all over the world to help them understand the causes and mechanisms of genetic diseases as well as relations among populations. As the project officer it was my responsibility not only to work with the staff of the repository, which was funded by a contract, but also to decide upon and prioritize which samples to collect. We monitored their work. I appointed and led an outside advisory committee and, since I was involved for, what did we say, 27 years, I guess my fingerprints are all over the cell repository.

GM: Where is that housed and how is it overseen and how do you maintain the viability of these cells?

JG: First of all, it was funded by a competitive contract for many, many years and then it transitioned a few years ago to a kind of grant. All these years it's been housed at the Coriell Institute for Medical Research, which is a facility in Camden, New Jersey. I think it's probably Camden's biggest employer. But how do they maintain the viability of the cells? They are kept at a very low temperature in liquid nitrogen.

GM: And they're available to any of your grantees or anybody?

JG: They are available to any researcher in the world, both academic and for profit.

GM: You have an idea that they're being used very frequently?

JG: That we do know. Thousands of cell and DNA samples are sent out every year. Interestingly, as scientific interests change, the types of samples requested vary from year to year. As a result, cell lines that were made many years ago sometimes achieve new popularity.

GM: What would these people do if these cells weren't available for their research?

JG: I suspect that it would be difficult to do some of the work that some of the people are doing. There are advantages to a repository. One is that different investigators can order the same cell line and know they're experimenting on the same material, which is not something that you could necessarily be sure of if you're going to Dr. Smith down the hall and asking, "Can I have a couple of your samples?" I should add that every sample undergoes extensive quality control when it's acquired and at various other times. So, that's one thing. The other is that not every lab has access to the kinds of materials that are in the repository. Some of these materials are relatively rare, particularly those from some of the families. One of the best-known families is the Huntington's Disease family from Venezuela, containing a huge number of samples. You know those wouldn't be available.

GM: So all this time you were on the lookout for new—I can't say the word—new cells that would be added to the repository? It obviously has grown over these years.

JG: Each year there's a target number of samples that the repository is supposed to be acquiring, and a set of priorities for the types of samples.

GM: It must be expensive to maintain that repository and to take care of the cells and sort them out and so forth.

JG: Yes, it is.

GM: I would think so, but you consider that a very important endeavor for science in general.

JG: I do, yes.

GM: That's very important and you worked on that as a project director for so many years. Also tell us about your interest in some of this research training and career development that you talked about. I'm particularly interested in how you promoted the careers of women and members of other underrepresented groups.

JG: Okay, I mentioned before that from practically my earliest days at NIGMS I managed a portfolio of institutional training grants in genetics and at various times I also managed individual postdoctoral fellowships in genetics. Then as I advanced in my career, especially as a division director and deputy director, I had the opportunity to have a much broader view of training and career development. Since NIGMS is such a strong supporter of training and career development, it was natural for me to be steeped in the importance not only of training students and postdocs well but also of assuring diversity in the biomedical research pool. Among the many activities over the years, and I probably can't even remember all of them, I was involved in being active on a couple of committees in conjunction with the Office of Research on Women's Health. One was the NIH Working Group on Women in Biomedical Careers and the other the Biomedical Workforce Working Group. For one of these I organized a series of workshops on the obstacles to women's career advancement. At three separate meetings—women scientists at one, university administrators at another, and funders at a third—be brought together experts to try to figure out if there are ways to facilitate women's careers. We obviously identified a lot of obstacles but addressing them is difficult. However, recently NIH as a whole has been making some good progress in that regard.

I also worked for a time in collaboration with the Chief Officer for Scientific Workforce Diversity, where we developed training on implicit and explicit bias for program and review staff and study section members. This was an attempt to create a more level playing field for all applicants. Of course, as I mentioned before, I was a big promoter of the New Innovator Awards and of a rather unique program that NIGMS started. It's called the ESI MIRA, the Early Stage Investigator Maximizing Investigators' Research Award, and it is also targeted to early career stage investigators. Analyses have shown that the success rate for new MIRAs and for competitive renewals of MIRA recipients is higher than for ESI recipients of R01s.

One thing I'm proud of is a paper that I published in 2018 with several colleagues in NIGMS' data analysis group. We showed that women in academia apply less frequently for a grant, but when they do apply they're just as successful as men in getting funded. In addition, their longevity, that is the length of time they continue to receive grants, is nearly the same as that of men. We consider that really a good news story because it should tell women that, "Don't be afraid to apply; you're going to do just as well and you're going to succeed in academia," if you consider getting a grant as a proxy for success in academia, which most people do.

GM: The term "diversity" has become a catchword right now since all the findings of the recent COVID pandemic has shown up the lack of diversity in some of our medical care issues, regions, and so forth here and in the world. But it looks like NIH was way ahead of the diversity accomplishment. And you were one of the forerunners in all of this and probably have led into the current NIH special attention to diversity needs that has been recently announced. It looks to me like you were truly a pioneer in this field as far as NIH is concerned.

JG: Well, I don't want to take more credit than I deserve, and I think NIH as a whole has been making a lot of effort in improving diversity in both its own workforce and in the biomedical research enterprise. NIGMS has been particularly active in this because of the career development aspect of its mission.

GM: We can only hope that things will continue to get better and advertised more widely because NIH and NIGMS deserve a lot of credit for thinking ahead on these issues. I consider that very important and that you, in particular, get some recognition for that.

Also, I noticed a couple times you were detailed to the NIH Office of the Director as executive secretary of a panel to assess the NIH investment on research in gene therapy and to help establish NIH's first human embryonic stem cell registry. These are really early attempts to solve some of the major ethical problems that were looming as genomes were being fully elucidated. Tell us about your activity in this regard.

JG: Before I do, I just want to say that all these years at NIH and NIGMS weren't repetitive or boring because there was always something new that I was involved in. What you just mentioned are two examples of that. The Office of the Director often brings in staff from the institutes when they need specific expertise. When Dr. Harold Varmus was NIH director, gene therapy was first being tried on patients. He felt rather strongly that gene therapy was moving ahead in the clinical setting before there was a good scientific foundation for it. For example, where did the foreign genes insert and what was the consequence of landing in that location? He convened a blue-ribbon panel that was known as the Orkin-Motulski panel because it was co-chaired by Stuart Orkin and Arno Motulski. The panel was charged with considering all aspects surrounding gene therapy, from vectors to training. I was asked to be the executive secretary of this panel. Although I had to understand the science underlying gene therapy, my role in this was mostly organizational. I have to say it was a tremendous experience in many respects as we traveled around the country to hear testimony from various scientists and clinicians. A final report was issued in 1995, and I think Dr. Varmus proved to be correct. We were getting a little ahead of ourselves with clinical studies before we knew enough about what we were doing.

The other detail that you mentioned was the stem cell registry. Research on human embryonic stem cells was permitted in the United States but federal funding could not be used for it. In 2001, when George Bush became president, he issued a policy that changed this. It allowed federally funded research on a very limited number of stem cell lines that had already been derived using non-federal funds, so it was kind of a way to get around the issue. The first thing that had to happen to implement this policy was to identify just where these cells were located, confirm their origins, and negotiate with the owners of the cell lines over availability and patent issues. All of that was needed to create a registry of permitted cell lines. I was detailed to help do this. At the time there were only a handful of eligible cell lines and we worked very, very hard to get as many as possible into the registry. We considered that at the time as success. Going forward many years beyond the time that I was at all involved, President Obama in 2009 expanded the guidelines, and the registry now contains hundreds of cell lines, but back then I think it was only about seven or eight that were available, and that investigators could actually use.

GM: You're describing a transition on your part from medical research into medical ethics. It sounds to me that you now are obviously a total guru in that area. Many of those were very, very difficult issues that became evident as the genome was being described in detail and all these genetic discovery activities were first in process. I really think those involvements were a very remarkable addition to your credentials. Also, along the same line you were chair of a trans-NIH working group that wrote a document entitled “Points to Consider When Planning a Genetic Study that Involves Members of Named Populations.” What are “named populations” and what were we concerned about in this ethical effort?

JG: This goes back to my time as project officer of the cell repository. I mentioned when I told you about what the repository collected that some of the samples were from individuals from specific geographic or ethnic populations. All the samples that were submitted and all the cell lines and DNA samples that were sent out to investigators, of course, had to be approved by Institutional Review Boards, IRBs. But when you think about people who are closely related either by geography or by ethnicity, they may share a considerable amount of their DNA sequence, so there was concern that studying a sample from one or a few people from a particular population might lead to information about the population more broadly—and some of the people in that population might not want that information revealed. Basically, they say, “It's fine the IRB approved it and I'm happy with sending my sample out, but how about all the rest of the people in my group?” I chaired a committee that was made up of staff from many of the institutes. We had several meetings among ourselves but also with outside ethicists. We published this document that you referred to, “Points to Consider.” Its essence really is the importance of the concept of community consultation, which means bringing together representatives of the population to consider whether it wants to be part of the collection or not. The article describes community consultation in detail and what's meant by the process.

GM: Your involvement in so many facets of this NIGMS activity is absolutely overwhelming. Just the growth and change over the years were remarkable. Are there any other particular areas that you were especially involved in that you want to mention? It would seem you were on committees spending a lot of the time and reaching very important decisions. Also, I noticed that you were the chair of our Stetten Museum's Advisory Board from 2001 to 2006. How did you get chosen for that and what were the challenges for history at NIH then and what are the challenges now as you see them?

JG: In answer to your question, I really don't know how I got tapped for the job of chair of the Stetten Museum Advisory Committee. The only thing I can guess is that some years before that, the Stetten Museum was putting together an exhibit on genetics and they needed someone with expertise in genetics to be on the committee to advise the curator on what should be included, and I was asked to serve. This was one of the most fun things that I have ever done at NIH. It combined my love of genetics with my interest in communicating to the public, and at the same time it gave me a chance to see how even a simple museum exhibit is conceived and developed. That’s probably how Victoria Harden, who was the head of the museum at that time, came upon me as a possible chair.

As for the challenges of history at NIH, I'm a strong believer that keeping records and objects as the History Office does is very important. I read a lot of history and it's clear that without the artifacts that exist our understanding of events that took place at a particular time would be far less rich. I think the main challenge for the History Office, and I'm sure its staff knows this, is communicating its crucial role within NIH and also raising awareness of its existence to the public more broadly.

GM: Thank you for those comments. They're very much right on as far as I, as a volunteer in this department, agree with you completely with that. Over these years I also noticed that you've received a lot of recognition and awards. You were there for 45 years. At NIH you recorded a lot of outstanding accomplishments, some of which we've talked about. The most recent recognition is an annual lectureship named for you. I think that's a terribly exciting recognition. Tell us about that.

JG: This was quite a surprise. After I retired, the NIGMS director, Dr. Jon Lorsch, announced that our Early Career Investigator Lecture was being renamed the Judith H. Greenberg Early Career Investigator Lecture. I first heard this when I was watching the streaming of our advisory council, and I was just totally floored by the announcement. This Early Career Investigator Lecture is meant to highlight some of our newer scientific superstars. The lecture itself is aimed at undergraduates and graduate students and postdocs although it's open to everyone. It's unusual in the sense that a part of the time is devoted to hearing about the speaker's career and the career path that the person took. NIGMS has only two named annual lectures and so I was just incredibly honored by having one named after me. I'm particularly pleased also that it recognizes my interest in early career scientists, as we've discussed, and my involvement in various training and career development programs over all these years.

GM: That's an annual lectureship, is it?

JG: Yes.

GM: Who picks the presenters?

JG: It’s our director who ultimately does that. As deputy I would sometimes make suggestions; in fact, our whole senior staff would make suggestions. We’ ve selected some really good, interesting younger people whom you just know are going to make their mark.

GM: The nice part about it is that, now that you've retired, about 14 months ago, you have a reason to go back on campus at least once a year to listen to a lecture. You have been at NIH all these years and they're all productive years as I read the literature and read the history. Do you have any comments about what's happened at NIH, what the changes have been, and what you would like to record from your own observations of these more than 40 years of change?

JG: Like all successful organizations, NIH has evolved over the years. The way it does business has changed from my early pre-computer days to our current heavy emphasis on data and analysis. But what has remained the same are the important things – the quest for the best science and the dedication of NIH's staff to its mission. I've been extremely fortunate to have spent my career in this wonderful place.

GM: You have been an important member and key developer of some of these advances. It's remarkable. Now that you're retired, what are your plans? What are you going to do with yourself?

JG: I never really expected to retire into a pandemic, but what I wanted to do, and maybe eventually will have the opportunity to do, was travel and museums and concerts and plays, which are all things that I love, as well as spending more time with family (my daughter and son-in-law and two wonderful grandchildren) and friends. I've been making the best of all the wonderful technology that we can use when we're stuck at home. And I read a tremendous amount, both about scientific and non-scientific topics.

GM: I certainly wish you well in your retired phase of life. It looks to me like you chose a very early part of your life to retire, but I guess you feel you've provided your contributions very extensively and it is time to move on. I think this interview has been extremely educational, both about the special role NIGMS has played in research, offering diversity and research training and support of all the extramural scientists, and also many of those very special issues that you've been involved with have been notable. I have lived professionally through this period of time and know of all the difficult questions that were raised about such subjects as genetics and new findings and medicine and new developments that have required ethical interventions and understanding, and I think you have outlined so many of these things in this relatively brief interview. I want to thank you for your reports and your accomplishments and for your leadership during all of these years and only hope you can continue to be available and be involved and participate from time to time as necessary with all of your background in furthering the missions of NIGMS and NIH. Thank you so much for your time and your willingness to review and record many of your accomplishments, all of which I consider so important in the advancement of science.

JG: Thank you very much, Gordon. It's been great talking to you.

GM: Yes, I've really enjoyed it.